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Teaching Course 18

Testing of cognitive functions by the neurologist (Level 1)

How to explore confused patients

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Lyon 1

Teaching course 18

UNIVERSITÉ DE LYON

How to explore confused patients

Testing of cognitive functions by the neurologist (Level 1)

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Confusion / delirium

- Confusion (delirium) is a disturbance of consciousness that develops acutely, tends to fluctuate, and Is associated with inattention, impaired cognition, and perceptual disturbances.

- Complex and fuzzy pathophysiopathology
  - Preexisting condition : age >70, hospitalisation, depression…
  - Acute condition : drug overdose, metabolic, fever, sepsis…
  - Iatrogenic/environmental : medication, physical restraints…

Post-traumatic amnesia (PTA)

Acute brain injury
Coma
Locked-in syndrome | Vegetative state | Chronic coma (very rare) | Brain death
Minimally conscious state | Permanent vegetative state (>3 months if non-traumatic, >1 year if traumatic)
Confusional state
Increasing independence | Death
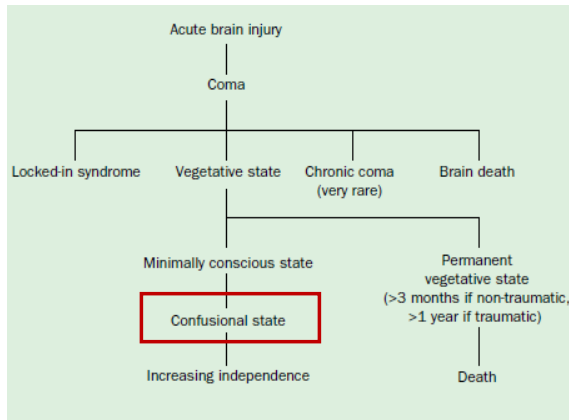
Laureys et al. Lancet Neurol 2004

- PTA or confusion phase after TBI shares many features in common with acute delirium but the brain lesion is central
- Concern almost all patients during the course of recovery after a post-traumatic coma
- Duration extremely variable from a few minutes to many months

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Clinical signs

- Negative signs
  - Altered level of consciousness
  - Temporo-spatial disorientation
  - Impaired cognition with anosognosia ++
  - Behavioral disorders: agitation, anger, deambulation
  - Anxious perplexity, depression

- Positive signs
 - Confabulation
  - Hallucination
  - Delusions

Which cognitive functions should be explored ?

- Awakening phase
  - Assessing recovery of awareness
  - The restauration of communication
- Post-traumatic amnesia
  - **Temporo-sptatial orientation, identity**
  - **Memory**
  - **Attention span**
  - Language
  - Executive function
  - Spatial cognition

How to explore cognitive functions

- Behavioral observation ++

- Classical cognitive tests often inappropriate
  - Impaired vigilance
  - Language disorders
  - Motor impairment
  - Sensory impairment
  - Pain and comfort
- Specific tools ?

Awakening phase

Normal	Coma	V.S.	MCS	LIS / CMD

WAKEFULNESS   *AWARENESS*
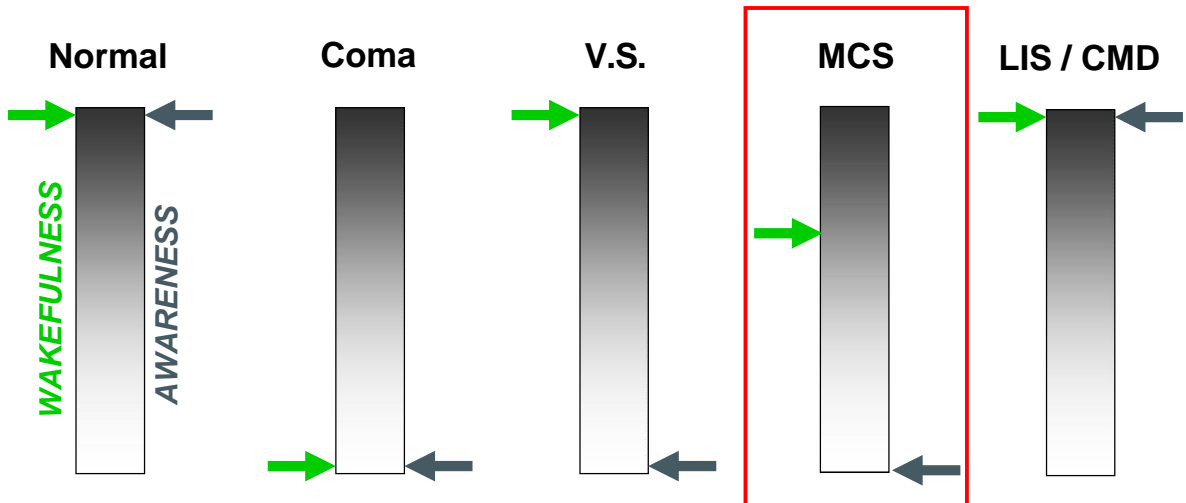
Adapted from Laureys et Giacino


Minimally conscious state (MCS)

- Diagnostic criteria

  - Oriented movement
  - Intelligible verbalization
  - Fixation and visual pursuit
  - Accurate emotional signs (cry, smile…)

- Emergence MCS

  - Functional interactive communication
  - Functional use of object

Giacino ; Neurology 2002

Specific scales
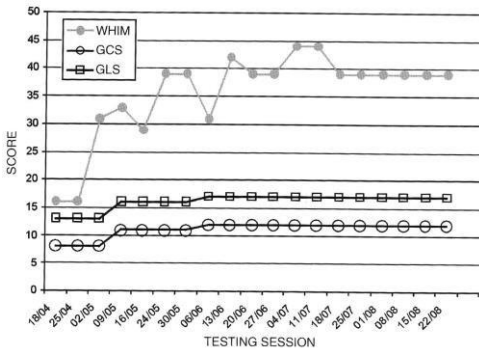
Majerus et al. Progress Brain Res. 2005

MCS diagnosis

N= 77

GCS	FOUR	WHIM	CRSR
24	32	36	45
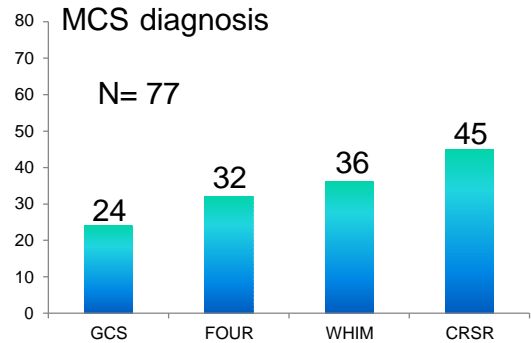
Schnakers et al. Brain Injury 2008

Assessment Scales for Disorders of Consciousness: Evidence Based Recommendations for Clinical Practice and Research. *Archives of Physical and Medical Rehabilitation*, 2010.

Coma Recovery Scale Revised

- Different sub-scales : auditory, visual, motor, oro-motor/verbal, communication, arousal
- Behaviors that reflect voluntary or intentional responses are pinpointed by a star
- The repetition of evaluations increase the reliability of the diagnosis (at least 5 repetition)
- Items more frequently associated with MCS:
  - visual fixation, visual pursuit, movement in response to order, oriented response to noxious stimuli

Giacino, Kalmar and Whyte, – APMR 2004; Wannez et al. 2017

Visual function sub-scale

5 - Object Recognition *
4 - Object Localization: Reaching *
3 - Visual Pursuit *
2 - Fixation *
1 - Visual Startle
0 – None

Thonnard et al. BI 2014

Visual function sub-scale

5 - Object Recognition *
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Communication

- Yes – No code
  - eyelid closure
  - Visual pursuit
  - Any preserved movement

- If no behavior response but cortical modulation of the brain to verbal commands => BCI
  - fMRI
  - EEG

Communication
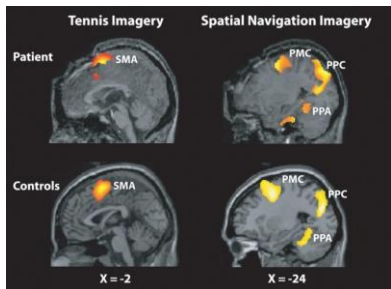
Owen et al., Science 2006

Monti et al. NEJM 2010

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BRAIN
A JOURNAL OF NEUROLOGY

REVIEW ARTICLE

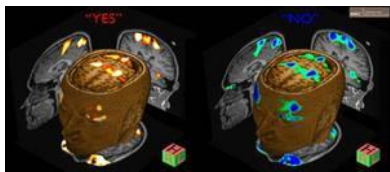# Minimally conscious state or cortically mediated state?

Lionel Naccache[1,2,3,4]

	State #	State name	Source of evidence	Typical examples
Evidence of unconsciousness ↑	1a	Comatose state	Behaviour and functional brain-imaging	GCS + compatible EEG
	1b	Comatose state	Behaviour	GCS
	2a	VS/UWS	Behaviour and functional brain-imaging	CRS-R + EEG/fMRI/PET
	2b	VS/UWS	Behaviour	CRS-R
	3a	CMS	Functional brain-imaging	EEG/fMRI/PET (Owen et al., 2006; Sitt et al., 2014; Stender et al., 2014; Demertzi et al., 2015; Schiff, 2015)
Evidence of consciousness ↓	3b	CMS	Behaviour ± functional brain-imaging	CRS-R ± EEG/fMRI/PET
	4a	Conscious state	Functional brain-imaging	EEG/fMRI/PET (Monti et al., 2010; Cruse et al., 2011; Goldfine et al., 2011)
	4b	Conscious state	Behaviour	CRS-R

PTA assessment

- Language
- **Temporo-spatial orientation and identity**
- **Memory**
- **Attention span**
- Executive function
- Spatial cognition

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Language

- Is language preserved (at least understanding for simple commands) ?

  - In the absence of verbal communication, use yes/no questions or questions with 2 or 3 options

  - Ask the question in different ways (positive and negative formulation)

  - The effector is the best reliable response that you can obtain : Visual pursuit, subtle movement of the head / limbs…

Temporo-spatial orientation and identity

- Temporo-spatial orientation and identity
  - What is your name ?
  - When were you born ?
  - Where do you live ?
  - Where are you now ? City ? Building ?
  - What time is it now ?
  - What day of the week is it ?
  - What day of the month is it ?
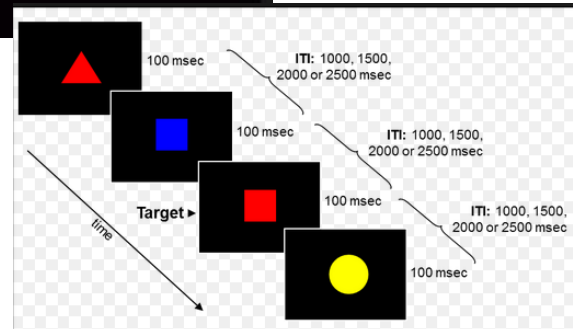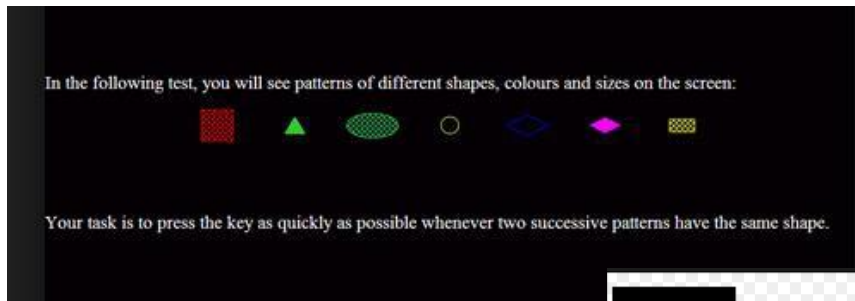 - What is the month ?

Amnesia

- Global declarative memory disturbance : dysfunction in memory encoding, storage and/or retrieval
  - Who came to see you yesterday ?
  - What did you eat yesterday ? this morning ?
  - Delayed recall : words, pictures
- Retrograde amnesia (defective memory prior to TBI). Greater decline in recall for events closer to the date of injury than for events in the more distant past (Ribot's law)
  - Can you describe the last event you can recall before the accident ?
  - Recall of auto-biographical events before the accident (check with family)
  - What is the first event you can remember after the injury ?

Attention

- Impaired vigilance / alertness

  - Alertness refers to the condition of general wakefulness that enables a person to respond quickly and appropriately to any given demand.

- sustained attention

  - Concentrating on a task is a typical requirement in working life. This involves focusing attention on a mentally demanding activity for a sustained period of time.

  - Sustained attention is not an ability that can be captured easily in clinical practice.

Test of attentional performance (TAP)

In the following test, you will see patterns of different shapes, colours and sizes on the screen:

Your task is to press the key as quickly as possible whenever two successive patterns have the same shape.

100 msec — ITI: 1000, 1500, 2000 or 2500 msec

100 msec — ITI: 1000, 1500, 2000 or 2500 msec

Target ▶ — 100 msec — ITI: 1000, 1500, 2000 or 2500 msec

100 msec

Psytest 2.3.1
P Zimmermann and B Fimm

PTA assessment

- Specific scales

  • Westmead PTA scale (WPTAS)

  • Modfied Oxford PTA scale (MOPTAS)

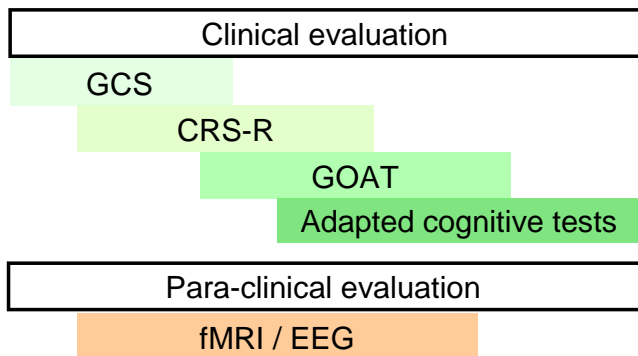 • Galveston Orientation and Amnesia test (GOAT)

The Galveston Orientation and Amnesia Test
Harvey S. Levin, Ph.D., Vincent M. O'Donnell, M.A., & Robert G. Grossman, M.D.

Instructions: Can be administered Daily. Score of 78 or more on three consecutive occasions is considered to indicate that patient is out of po

Question	Error Score	Notes
What is your name?	-2 _____	Must give both first name and surname.
When were you born?	-4 _____	Must give day, month, and year.
Where do you live?	-4 _____	Town is sufficient.
Where are you now:		
(a) City	-5 _____	Must give actual town.
(b) Building	-5 _____	Usually in hospital or rehab center. Actual name necessary.
When were you admitted to this hospital?	-5 _____	Date.
How did you get here?	-5 _____	Mode of transport.
What is the first event you can remember after the injury?	-5 _____	Any plausible event is sufficient (record answer)
Can you give some detail?	-5 _____	Must give relevant detail.
Can you describe the last event you can recall before the accident?	-5 _____	Any plausible event is sufficient (record answer)
What time is it now?	-5 _____	-1 for each half-hour error.
What day of the week is it?	-3 _____	-1 for each day error.
What day of the month is it? (i.e. the date)	-5 _____	-1 for each day error.
What is the month?	-15 _____	-5 for each month error.
What is the year?	-30 _____	-10 for each year error.
Total Error:		
Total Actual Score = (100 - total error) = 100 - _____ =		Can be a negative number.
76-100 = Normal / 66-75 = Borderline / <66 = Impaired		
Developed by Harvey Levin, Ph.D., Vincent M. O'Donnell, M.A., & Robert G. Grossman, M.D.		

Conclusion

Coma ➡ VS ➡ MCS ➡ TPA

CMD / LIS

Clinical evaluation
GCS
CRS-R
GOAT
Adapted cognitive tests

Para-clinical evaluation
fMRI / EEG

- Clinical evaluation
  - Low-tech – just take time
  - Find the best effector
  - Hierarchical (Wakefulness/ awareness / language / orientation / identity / memory…)
- Paraclinical evaluation

- Man, 22 years old
- Severe TBI (GCS = 3) after a car accident 5 months prior to evaluation
- Initial MRI – T2*